

1100 Seventeenth Street, N.W. Washington, D. C. 20036

FROM: W. W. Hough

(CATEGORY)

AND NASA

BELLCOMM, INC.1100 Seventeenth Street, N.W. Washington, D. C. 20036

SUBJECT: Trip Report - LM-A Technical
Management Meeting, July 2, 1968
at MSC - Case 620

DATE: July 18, 1968

FROM: W. W. Hough

MEMORANDUM FOR FILE

The agenda for the July LM-A Technical Management Meeting included presentations by Grumman on manual docking capability, LM-A dormancy after docking, and the probe/drogue problem. Headquarters personnel in attendance at MSC were E. P. Andrews/MLA, R. E. Storm/MLR, J. R. Porter and W. W. Hough/MLS. Technical direction to Grumman resulting from the meeting is summarized in the attachment to this memo.

EVALUATION OF RETENTION OF MANUAL DOCKING CAPABILITY

The approach was to evaluate probabilities of successful accomplishment of the LM-A mission through the final docking maneuver for (1) the clustered mission only, and (2) for either the clustered mission or the alternate mission. Cases with and without Abort Guidance System (AGS) remote docking capability and LM-A manual docking capability were analyzed. The probability of remote docking without AGS backup to the Primary Guidance Navigation and Control System (PGNCS) was given as .9908 and with AGS backup as .9924. With manual docking capability, further improvement to a .9930 probability of successful docking to the MDA was achieved. The probability of success of either the clustered or alternate mission final docking without manual docking capability was also .9930.

Use of manual docking capability requires, as an intermediate step, establishing the CM-SM/LM-ATM configuration of the alternate mission, and it was pointed out by O. K. Garriott/MSR that a decision to give up a sure alternate mission for a possible clustered mission was improbable. In addition, it was stated by Grumman that the current LM-A life is limited to 10 hrs. without ATM power. The NASA consensus seemed to be that manual docking capability should be eliminated, but Grumman was directed to leave it in pending completion of the unmanned rendezvous and docking studies. Elimination of the capability would allow deletion of manual flight controls and other displays and controls. However, further study of the impact of these deletions on LM-A design and ground checkout would be required. Elimination of the equipment might cost more than its retention.

CONFIGURATION STUDY OF DORMANCY AFTER CLUSTER OR CM-SM DOCKING

Grumman has examined the impact of increasing LM-A dormancy above the present baseline. In the present baseline configuration, the GN&C, RCS, Communication, and battery subsystems are dormant after docking. The equipment which remains active includes the cabin thermal control loop (which also controls the ATM control and display console temperature), oxygen and water accumulators for EVA support, electrical control assemblies, inverters, lighting control assemblies, a PCM timing reference for support of the ATM, and the caution and warning system.

The ATM control and display console requires active cooling. Use of a radiator on the LM-A, even if it is a separate loop, eliminates the need for a liquid coolant interface to another module, an interface which would have to be established in flight. The LM-A cabin temperature could be maintained by atmosphere exchange with another module, but in the case of the CM-SM alternate mission, Grumman expects substantial modifications to the CM-SM ECS would be required.

In general, increasing LM-A dormancy adds the eliminated function to another module and complicates the LM-A interface. Grumman recommends that the level of dormancy now existing in the baseline configuration not be increased.

PROBE/DROGUE/CPSM CONFIGURATION

The Crew Provision Storage Module (CPSM) and docking structure are being designed for axial loads induced during a CM-SM SPS burn and for bending and torsional loads induced during a revisit CM-SM docking. Minor mods to LM-A primary structure will be required. The CPSM height will probably be increased by 4 to 6 inches. MSC directed Grumman to eliminate the requirement for installation of a probe in the LM-A. Docking latch design (Apollo vs. Grumman four-latch) for re-visit mission docking loads therefore ceases to be a Grumman problem. MSFC is planning to use the Apollo ring in the MDA.

OTHER SUBJECTS

Major emphasis of LM-A reliability analysis to date has been to assist in the design decision making process. A report on a suitability analysis to determine the capability of Apollo LM equipment to meet LM-A requirements is due in mid-July. Present contractual effort does not include performance of total vehicle reliability estimates or apportionments. Such efforts require a more stable mission and configuration definition. It is not planned to initiate such efforts until after the PDR.

BELLCOMM. INC.

-3-

A list of critical information required for design of the LM-A in the present preliminary phase was given, and is available from the attendees.

A handwritten signature in dark ink, appearing to read 'W. W. Hough', written in a cursive style.

W. W. Hough

1022:WWH:ms

Attachment.

ATTACHMENT

Content of TWX to GAEC from MSC, July 3, 1968

Subject: Action Items and Technical Direction from AAP LM-A
System Technical Management Meeting No. 1

The first LM-A System Technical Management Meeting was held at MSC July 2, 1968. The following technical direction resulted from this meeting:

1-1 The baseline configuration of the LM-A will be changed to delete the docking probe and latches and replace with the Apollo drogue.

1-2 GAEC should provide for in-orbit storage of one probe, drogue and LM-A docking tunnel hatch.

1-3 The LM alignment optical telescope is required to provide manual backup capability to ATM star tracker.

1-4 The EVA coolant loop in LM-A should be separate for the two crewmen so that loss of coolant to one crewman does not affect coolant supply to second crewman.

The following information should be prepared by GAEC for presentation at the next System Technical Management Meeting tentatively scheduled for July 16, 1968, at MSC.

1-5 Prepare presentation on basic structural design of crew provisions storage module to include identification of stowage concepts and access capability.

1-6 GAEC should identify what configuration changes could be made to the LM-A if the requirement to support the backup mission is deleted.

Sgd H. E. Gartrell, Manager, Future Missions Project Office.

BELLCOMM, INC.

Subject: Trip Report - LM-A Technical From: W. W. Hough
 Management Meeting, July 2, 1968
 at MSC - Case 620

Distribution List

NASA Headquarters

Messrs. E. P. Andrews/MLA
 H. Cohen/MLR
 P. E. Culbertson/MLA
 J. H. Disher/MLD
 J. A. Edwards/MLO
 L. K. Fero/MLV
 J. P. Field, Jr./MLP
 T. A. Keegan/MA-2
 H. T. Luskin/ML
 M. Savage/MLT
 R. E. Storm/MLR

Bellcomm

Messrs. A. P. Boysen
 D. A. Chisholm
 D. R. Hagner
 B. T. Howard
 J. Z. Menard
 I. M. Ross
 J. W. Timko
 R. L. Wagner
Div. 101 Supervision
Dept. 2015, 2034 Supervision
All Members Dept. 1021, 1022, 1024, 1025
Department 1023
Central File
Library